Basis for conclusion

Next Steps

For More Information

- The association between asbestos exposure and disease is well established. Preventing inhalation of asbestos will reduce risk of disease.
- Mesothelioma incidence, tracked by the California Cancer Registry, is not higher than expected in western El Dorado County at this time. However, mesothelioma may take decades after exposure to appear.
- Although the community in general is estimated to have an increased risk of exposure and disease, individuals' risk may vary widely due to the sporadic nature of NOA occurrences and individual behaviors leading to exposure. Individual assessment by personal health care providers for those who are concerned about past exposures will be more efficient than general community screening in treating any health effects that may appear.

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Because of its geological history, the state of California (including portions of El Dorado County and many other counties) contains areas with a high proportion of silicate rocks high in magnesium; these rocks are called ultramafic rocks. Under certain geological conditions, ultramafic rocks can be altered to serpentinite, the greenish-colored "State Rock of California." This alteration process can also result in formation of different types of asbestos. Asbestos minerals can be formed in other types of rocks but they are more commonly formed in ultramafic rocks and near fault lines which provide necessary conditions for asbestos formation [1]. These rock types, along with geological conditions leading to formation of asbestos, have occurred not only in areas of California, but in many other places throughout the United States and the world.

For many years, geologists have been aware of the potential of serpentine rocks to contain asbestos. However, the potential for harmful exposures to the public to occur does not appear to have been realized until relatively recently. California was one of the first states to become aware of the potential for public exposure to asbestos deposits in the mid-1980s.

What is Asbestos? A General Term for a Group of Commercially Valuable Minerals

Asbestos refers to a special form of certain minerals that consists of long, thin, crystals (fibers) that are particularly strong, flexible, and heat resistant. They often form in bundles of very thin fibers called fibrils; their shape and flexibility means they can be woven or processed easily, but because they are silicate-based minerals, they don't react with other chemicals, conduct electricity, degrade, or burn. Asbestos minerals have been used for thousands of years. However, the scale and variety of uses, and the number of workers who mined and processed the asbestos, was small until after the industrial revolution, in the late 1800s.

Figure 3. Structural Differences Between Amphibole and Serpentine (Chrysotile) Asbestos
Both amphibole asbestos and chrysotile have a basic framework of silica tetrahedra, where a blue silicon atom is surrounded by gray oxygen atoms; oxygen atoms are shared between tetrahedra to form polymers with different structures. In amphibole asbestos, the polymer forms as a double chain (shown on the left) which can form long, thin fibrous structures. Chrysotile, in contrast, forms a sheet structure as illustrated on the right. Because of ionic charge imbalances the sheet tends to roll up in thin tubes which create the fiber. [Diagrams used with permission from Steven Dutch, Professor, University of Wisconsin – Green Bay]

While all asbestos is ultimately natural in origin, from a public health perspective, the term NOA is used to refer to asbestos and asbestos-like minerals that are not intentionally mined or used commercially, but whose disturbance could release fibers into the air, causing exposure and, possibly, asbestos-related disease.

After reviewing the literature on illness and NOA, (the whitewash and stucco and stove communities)

- The exposures are different. In the studies cited above, the exposures were not very well characterized, but certain observations can be made. The materials implicated contained high levels of asbestos and were sought out for specific uses; the materials were used widely in the towns; and because of this wide use, the exposures were probably consistent, relatively high and occurring for long durations. Specific occurrences of NOA in the El Dorado Hills area may be highly concentrated, but they are not very large, the NOA is not evenly distributed throughout the area, and the NOA (or material containing NOA) is not intentionally used for specific purposes.

Although these differences may be important, limited studies have suggested that exposure to NOA in California could be a problem. Pan *et al.* examined mesothelioma cases diagnosed between 1988 and 1997 (as reported in the State registry) in relation to possible occupational exposure and proximity to NOA (after controlling for occupational exposure) [78]. While the authors did find a statistical correlation between proximity to NOA and mesothelioma incidence, the study can only be considered suggestive because of the limited data available for analysis. Occupational exposure was determined using the longest occupation or industry listed for each case in the registry; this may miss important exposures that were not listed in registry data. Perhaps more importantly, for cases that had no known occupational exposure, the distance to NOA was measured using the house or street level address at diagnosis and the edge of the nearest ultramafic rock formation on geologic maps as a surrogate for NOA source rocks. The residence at diagnosis may not reflect the location where exposure

occurred many years previously, and ultramafic rocks do not always or exclusively host asbestos. Finally, studies of asbestos exposure generally indicate that exposure is highly dependent on the specific area of disturbed asbestos – asbestos concentrations often cannot be measured just a few feet away from the disturbed area. For this reason, the cited distances in Pan *et al.* may not be relevant for NOA exposures ("odds of mesothelioma decreased approximately 6.3% for every 10 km farther from the nearest asbestos source").

In summary, this review of scientific literature demonstrates NOA's potential to cause asbestos-related disease and supports the concern about NOA exposure in El Dorado Hills. Because of the differences cited above between exposure in El Dorado Hills and other NOA locations worldwide, and because of the limitations of studies using local health outcome data, ATSDR focused our evaluation on using risk assessment methods to assist in determining whether the exposures occurring in this community could be of concern.